CHAPTER 4
RESOURCE FUNCTIONS AND CONSIDERATIONS

The following chapter identifies the primary water resources functions of the waterbody to be protected by the proposed MFL as well as the baseline resource conditions for assessing significant harm. Considerations for making this determination are set forth in Section 373.042191) (a) F.S. which requires the water management districts when setting a MFL to consider changes and structural alterations that have occurred to the water resources. These considerations and exclusions are discussed below. Chapter 4 also contains a discussion of resource protection issues as well as policies and procedures established to protect these resources

WATER RESOURCE FUNCTIONS

The Loxahatchee River Watershed contains significant water resources that provide a wide range of functions and services to the regional system. These functions need to be clearly identified so that they can be adequately protected from significant harm. The primary water resource functions that were considered in the development of MFLs for the Loxahatchee River and estuary include:

- Protection of fish and wildlife habitat
- Preservation of the river's wild and scenic values
- Providing drainage and flood protection for surrounding areas
- Water supply
- Recreation
- Navigation
- Preservation of historical and archeological values
- Water quality improvement.

Fish and Wildlife Habitat.

A large portion of the Loxahatchee River watershed remains undeveloped and retains extensive native plant and animal communities. The river's tributaries and wetlands provide a regional wildlife corridor and habitat for important species such as manatees, otters, alligators, and many varieties of birds. Adequate freshwater flow and water levels are required to maintain these habitats for plants and animals. Maintenance of sufficient water depths and hydroperiods within the upstream watershed and providing sufficient flows to the river are needed to protect existing plant and animal communities. The upstream freshwater portion of the River provides important habitat for freshwater (riverine) species of fish that are important to both recreational

fishing interests and wading birds. Freshwater species include largemouth bass, speckled perch, bluegill, shellcracker, redbreast, warmouth, bowfin, channel catfish and many species of minnows. The freshwater swamp community contains a number of species of trees and shrubs that provide important specialized habitats and food (e.g. fruits) to birds, especially migratory and endangered species, and other wildlife. These natural systems also provide treatment capacity to ensure that high quality water flows into the river and estuary.

The downstream estuary provides habitat for juvenile and adult estuarine species such as snook, mangrove snapper as well as juveniles organisms that populate offshore reef communities. The Loxahatchee estuary is also habitat for several endangered and threatened species including sea turtles, manatees, and Johnson's seagrass (*Halophila johnsonii).* The entire Loxahatchee River is designated by the U.S. Fish and Wildlife Service as critical habitat for West Indian manatee (FDEP and SFWMD 2000). The maintenance of viable estuarine ecosystems requires a proper balance of freshwater inflow -- sufficient freshwater flow to provide brackish conditions at appropriate locations and time periods and avoidance of high volume freshwater flows that may destroy or damage sensitive plants and animals.

Preservation of the River's Wild and Scenic Values.

Based on its natural scenic qualities, diverse native plant and wildlife communities, and in order to preserve the natural landscape, the Northwest Fork of the Loxahatchee River was designated as Florida's first federally designated "Wild and Scenic River" in 1985. The upstream freshwater portion of the river is characterized by its extensive and diverse bald cypress river-swamp community which represents an important component of the regional ecosystem. These habitats include cypress swamp, freshwater marsh, wet prairie, slough, river, stream, pine flatwoods, sand pine scrub, oak scrub, and hardwood hammock. The cypress swamp community is both a unique and important habitat and represents one of the last remaining areas of this type in South Florida (McPherson and Sabanskas 1980, USDOI/NPS 1982).

The cypress swamp supports a complex and diverse community structure comprised of low understory groundcovers and shrubs, medium height sub-canopy shrubs and hardwoods, and high canopy hardwoods, palms and bald cypress. The high canopy provides important habitat for a number of protected epiphytic plants such as ferns, bromeliads and orchids (USDOI/NPS 1982). The area also supports a diverse population of animals, including many that utilize surrounding upland and estuarine habitats. Inundated and exposed benthic areas of the swamp community are inhabited by invertebrates (leeches, worms, juvenile and adult insects, crustaceans and mollusks), amphibians, fish, and reptiles. Understory vegetation provides refuge and food for a variety of small to large mammals, reptiles, and insects. Tree trunks provide nesting cavities for birds and small to medium mammals. In addition, the forest canopy is an important habitat for birds, offering food (e.g. fruits, berries), refuge, roosting and nesting sites (Ewel 1990).

A total of 267 animal species have been observed in and along the River and estuary (FDEP and SFWMD 2000). The cypress river swamp community supports a number of species that have been identified as endangered, threatened or species of special concern by the Florida

Fish and Wildlife Conservation Commission, or listed as threatened or endangered by the U.S. Fish and Wildlife Service (**Tables 9 and 10**, Chapter 2).

The long-term decline in the extent and health of the cypress river-swamp community along the upstream portion of the Northwest Fork appears to be linked to hydrologic alterations of the river and its watershed, as well as past dredging activities in the estuary and Jupiter inlet. Combined, these two factors have resulted in reduced freshwater flows to the River, lowering of the groundwater table and increased saltwater intrusion of the cypress river-swamp community during dry periods. Sufficient freshwater flows are required during the dry season to protect the existing cypress community from further degradation and loss of natural function.

Drainage and Flood Protection.

The Loxahatchee watershed and its rivers, canals and wetlands comprise an area of more than 200 square miles. Water levels in the rivers and canal systems are managed to provide for drainage of land and storage of water during the wet season and adequate conveyance capacity to protect lives and property in surrounding upland residential areas from flood damage during severe storm events. The amount of water that can be stored in the basin is limited due to the lack of sufficient storage capacity. For this reason, water must be discharged to tide in order to provide flood protection within the basin. Lack of regional storage can act as a constraint on the District's ability to fully meet the proposed MFL until increased storage capacity is available.

Water Supply.

The C-18 Canal is not directly utilized as source of water supply for local utilities. However during high flow conditions, the Town of Jupiter has the ability to divert water upstream of S-46 into a series of surface water interconnects of lakes and canals to provide higher stages that allow for recharge of the surficial aquifer. SeaCoast Utilities has a similar system whereby C-18 Canal water can be diverted into a system of lakes within the Golf Digest project to provide recharge during high flow periods. When water levels drop below a specified level within the C-18 Canal, these utilities can no longer divert water away from C-18 as matter of their permit conditions.

The Town of Jupiter currently serves 20,000 customers and has a treatment capacity that can produce 27 MGD to respond to dry-season peak demands. The utility has three treatment methods: lime softing, ion exchange, and reverse osmosis. The lime softing and ion exchange plants use freshwater taken from 150-200 ft. deep within the surficial aquifer. In 1989, the Town of Jupiter became one of the first large municipalities to employ reverse osmosis (RO) as state-of-the-art water treatment technology. The RO system is capable of producing 12 MGD from wells drilled 1,500-2,000 feet deep within the Floridan aquifer. This brackish water is forced under high pressure through a semi-permeable membrane to produce a source of drinking water that does not compete with the surficial aquifer or the Loxahatchee River system. A waste product of this operation is brine, a concentration of salts, metals and other minerals that result from the RO process. The Town of Jupiter aerates this concentrate to remove hydrogen sulfide and adds dissolved oxygen before it is discharged into a mixing zone downstream of S-46 (C-18

Canal) with final discharge to the Southwest Fork of the Loxahatchee estuary. This process currently satisfies FDEP's water quality criteria for brine discharge to surface waters. The Town of Jupiter has requested the District consider establishing a minimum flow for the Southwest Fork of the Loxahatchee estuary to provide for dilution of the brine effluent to avoid potential water quality problems at the point of discharge.

The Loxahatchee River and its upstream wetland communities provide storage, retention, and infiltration sites for surface water flows. Both groundwater sources are used within this basin to meet potable (urban) water supply needs, and for irrigation of landscape and agricultural crops. The establishment of a MFL for the Loxahatchee River will help to prevent further saltwater intrusion of the river corridor groundwater table. Increasing the risk of salt water intrusion into coastal wells is a major water supply issue for northern Palm Beach County and the Jupiter area in particular. This problem will only increase through time as development increases in the area and sea levels continue to rise. Establishing MFLs for the Loxahatchee will provide another mechanism for protection of the coastal aquifer.

Recreation.

The many wetlands and surface waters in the watershed provide extensive opportunities for recreational fishing, boating, hunting and waterskiing. Significant recreational opportunities are provided in Jonathan Dickinson Park, including camping, hiking, canoeing, kayaking, motorboating, and wildlife observation. The Trapper Nelson Interpretative Site has educational, historical and archaeological features. The Loxahatchee Queen river boat offers daily cruises for sightseeing. A Girl Scout Camp and a Boy Scout Camp are located adjacent to the Park. The estuary includes DuBois and Jupiter Inlet parks, which are used extensively used for recreational boating, fishing, and swimming and family picnics. Many of these uses depend on providing adequate water levels, flow and water quality to support healthy plant and animal communities along the Northwest Fork of the river and downstream estuary as well as safe public contact. Maintenance of a minimum flow and level is needed to provide for adequate access and enjoyable use of the resource. MFLs are also necessary to sustain the vegetation communities that provide the landscape and wildlife that support these recreational activities. Impacts on recreational use of the river occur when low flows and low water levels impair the ability of the public to access the wild and scenic portion of the river by canoe or kayak

Navigation.

The estuarine portion of the system supports navigation along the Intracoastal Waterway (maintained by the, U.S. Army Corps and Florida Inland Navigational District). Jupiter Inlet District maintains the Jupiter Inlet with a channel depth of -13 feet NGVD. Construction and maintenance of deep channels for navigational use and connection to the ocean at the inlet are in part, responsible for the increased extent of saltwater intrusion that has occurred in the Loxahatchee River during the past century.

Discussions with canoe rental concessions that utilize the NW Fork of the river on a regular basis indicate that when flows over the Lainhart Dam are less than 35 cfs, navigation and

recreational use of the NW Fork becomes impaired. Access to the river by recreational boaters, fishermen, canoeists and kayakers, becomes limited and at times, is restricted. Persons who have used the river during these low flow periods report that many of the littoral areas and shoals are exposed or contain only a few inches of water at low tide, thereby creating conditions that limit navigation and recreational use of the resource.

Historical and Archeological Values.

The upper segment of the Northwest Fork of the Loxahatchee River is noted for its rich historical significance. The area contains numerous sites that were used by pre-historic Indians (e.g. middens). The oldest of these sites date back to the Late Archaic period, from 3000 to 750 BC. Remains of two battles that occurred between Europeans and Indians in pre-settlement times have been located along the River corridor (the "Loxahatchee Battlefield"). A more recent historical site is the Trapper Nelson zoo and homestead, located within Jonathan Dickinson State Park. Segments of the River near these sites have been federally designated as "Wild", "Scenic", or "Recreational". The wild and scenic segments of the River have been protected in order to preserve the biological (i.e., bald cypress community), cultural, and scenic values for future generations. Establishment of MFLs for the Northwest Fork will aide in providing the needed freshwater flows required to maintain these historical and archeological sites in a condition similar to pre-settlement times.

Water Quality Improvement.

In addition to its importance as fish and wildlife habitat, the Northwest Fork provides an important source of clean freshwater to the estuary. The District has responsibility to ensure that the establishment of MFLs at least does not hinder, the ability to meet applicable state and/or federal water quality standards. The Loxahatchee-Lake Worth Creek Aquatic Preserve has Class II and III waters. Outstanding Florida Waters occur within Jonathan Dickinson State Park and along the Wild and Scenic segments of the river. C-18 Canal is a Class I water body but is not directly utilized as a source of public water supply. These classifications are summarized in **Table 12.**

Table 12. Water Quality Classification of Waters in the Loxahatchee River

CLASS	GENERAL DESCRIPTIVE USE	APPLICATION WITHIN THE LOXAHATCHEE RIVER
I	Potable Water Supply	SFWMD Canal C-18: Freshwater portion upstream of Control Structure S-46 is not directly used for water supply
II	Shellfish Harvesting and Propagation	Loxahatchee River: Upstream from FEC Railroad Bridge including the North Fork, Northwest Fork, and Southwest Fork to the SFWMD Structure S- 46
III	Recreation and Propagation of Fish and Wildlife	Loxahatchee River: Downstream from the FEC Railroad Bridge to the Jupiter Inlet, and the SIRWCD Canal C-14

Source: SFWMD, 2000 (Wild and Scenic River Plan)

Although water quality in this system generally meets, applicable standards, problems occasionally occur in the river and estuary with respect to dissolved oxygen levels, coliform bacteria and total nitrogen (FDEP 1996; 2000*).*

The primary source of water to the river is the G-92 structure and the Loxahatchee Slough, which has water of good quality. The relatively undeveloped basins along the Northwest Fork and Kitching Creek provide water that has little, if any, human-contributed sources of pollution. Water discharged from some basins along the River contains suspended solids, nutrients, pesticides and other contaminants that impact the River and downstream estuary (FDEP 1998). The bald-cypress communities that fringe the upstream portion of Northwest Fork provide important water quality functions in the form of reduction of nutrients and other pollutants. These communities provide a significant water quality improvement function (H.T. Odum et al., 1977; Ewel and Odum, 1984; Dierberg and Brezonik, 1984, 1985). The MFL seeks to minimize significant harm to this community, thus protecting this water quality function.

RESOURCE PROTECTION ISSUES AND CONCERNS

The Northwest Fork of the river contains one of the last pristine examples of a subtropical riverine cypress swamp in south Florida. Protection of this resource requires reducing or reversing the current trend of mangrove invasion within the upstream freshwater portion of the river by maintaining minimum baseline freshwater flows to the Northwest Fork. Maintenance of freshwater habitats in the mid-river region is also desirable to maintain existing populations and distribution of wildlife (e.g., fishes, alligators, turtles and otters) that require freshwater habitat. Reduction of sediment loading from tributaries is required to protect benthic communities in the river and estuary.

The Loxahatchee watershed is comprised of both surface and groundwater resources that are closely linked together. The surficial aquifer system receives recharge from the land surface (uplands and wetlands within the watershed). The surficial aquifer also provides an important source of freshwater base flow that maintains upstream wetlands and provides freshwater discharge to the river and estuary. Because of this relationship, withdrawal of water from the surficial aquifer system during dry periods has the potential to affect water levels in surrounding lakes and wetlands, reduce base flows to rivers and streams, and may therefore affect salinity conditions within the river and estuary as well as result in further saltwater intrusion of the aquifer. At present, there is not detailed hydrologic information regarding the role that groundwater plays in providing base flows to the river or estuary.

Monitoring of consumptive use is carried out by the SFWMD during drought periods to ensure that withdrawal of water for human use is not decreasing the amount of water available for discharge to the river. Provisions need to be made to ensure that minimum flows to the river occur to prevent saltwater intrusion and associated problems. Several options are being investigated as part of the MFL Recovery and Prevention Plan (see Chapter 5 for details) or implemented as part of the regional water supply planning process to provide additional water for the river such as the following:

- Improved hydrologic connection between the historic Loxahatchee Slough (i.e., West Palm Beach Catchment Area) and the Northwest Fork and improved management of water levels in Loxahatchee Slough.
- Construction of additional pumps, structures and conveyance capacity to allow more water to enter and be stored within the Loxahatchee Slough
- Construction of connections between the C-18 and C-17 basins and between Kitching Creek (NW Fork) and South Fork of the St Lucie River as part of the CERP planning process.
- Construction of a navigable submerged dam, low weir or artificial shoal to obstruct inland movement of the saltwater wedge during dry periods

CONSIDERATIONS AND EXCLUSIONS

Once the water resource functions to be protected by a specific minimum flow or level have been identified, the baseline resource conditions for assessing significant harm must be identified. Considerations for making this determination are set forth in Section 373.0421(1)(a), F.S., which requires the water management districts when setting a MFL, to consider changes and structural alterations that have occurred to a water resource. Section 373.0421(1)(b), F.S., provides exclusions from the MFL requirement by recognition that certain water bodies no longer serve their historical function and that recovery of these water bodies to historical conditions may not be feasible.

Considerations

The Loxahatchee River system has a variety of features and functions as follows that affect, or are affected by the need to establish Minimum Flows and Levels:

- Natural Systems
- Hydrology
- Water Supply
- Flood Protection
- Water Quality
- Navigation and Recreation

The section below provide a summary of how each of these elements was considered in the Loxahatchee River system.

Natural Systems

- Natural systems in the Loxahatchee River system have been significantly altered due to human activities during the past century.

- In spite of these changes, many of the original natural features remain in good condition. The Loxahatchee River and Estuary contain significant natural features, including threatened and endangered species and their associated habitats.

- Declaration of the estuarine area by the state as a state aquatic preserve and part of the riverine area by state and federal authorities as a Wild and Scenic River, indicates that necessary efforts should be undertaken to protect or enhance remaining natural features.

Hydrology

Hydrologic changes, which have occurred in the Loxahatchee River and Estuary due to navigation, drainage and flood control activities, have significantly altered the volume, timing and distribution of freshwater flow. Providing sufficient flows to maintain appropriate hydrologic conditions within the basin is the key element needed to maintain the integrity and viability of associated wetland, riverine, and estuarine ecosystems. Three primary threats to maintaining the integrity of this system are linked to water flows and levels as follows:

- Water levels in wetland systems that provide the base flow to the river have been lowered to provide flood protection to adjacent lands, and subjected to unnatural hydroperiods to meet drainage and flood protection needs of surrounding areas.

- Flow patterns in the river itself have been altered due to construction of the inlet and associated navigational channels and the removal of natural shoals from the estuary.

- Withdrawals of surface and ground waters for urban and agricultural use have contributed to alteration of the timing and volume of freshwater storage in wetlands and discharge to the river and estuary.

Water Supply

Two primary sources of water are used for water supply and agricultural irrigation within this watershed:-- withdrawals from the surficial aquifer; and withdrawal from the Floridan aquifer system

-

- Withdrawals from the surficial aquifer system have the potential to influence water levels in adjacent wetland systems and affect groundwater discharge to the river and estu

- Withdrawals from the Floridan aquifer system due not influence water flows to the river or estuary directly but create the need for brine disposal and therefore require a permit from FDEP.

Flood Protection

- The C-18 Canal is a component of the regional primary drainage system and provides flood protection for an area of 200 square miles. Numerous secondary and tertiary drainage features contribute flow to C-18 Canal.

- Construction of the C-18 Canal within the historic Loxahatchee Slough to meet drainage and flood control needs has resulted in significant lowering of water levels in adjacent wetlands, loss of regional storage and overall reduction in base flow to the Loxahatchee River and Estuary during dry periods
- C-18 canal has altered regional hydrology significantly by diverting drainage and runoff into the South Fork of the Loxahatchee Estuary. Much of this area, under natural conditions, would have provided sustained, dry-season base flow of fresh water to the Wild and Scenic portion of the NW Fork of the Loxahatchee River.
- During wet periods the network of drainage canals and structures results in discharge of excessive volumes of poor quality water, primarily to the estuary, that impact saline and brackish water communities in the Aquatic Preserves.
- The Jupiter Farms area (SIRWCD) covers approximately 10,315 acres and drains primarily to the NW Fork of the Loxahatchee River.

Water Quality

- Water quality data have been compiled and analyzed by the Florida DEP to determine current status and trends in this system. Results of this analysis indicate that water quality in this system is generally adequate to meet the designated uses, which include the following
- Public water supply (Class I) use for the C-18 canal upstream of the S-46 salinity control structure
- Fish and wildlife habitat/natural systems (Class III) use in the northwest and north forks and
- Shellfish harvesting (Class II) use in the estuarine portions and Aquatic Preserves.
- A few exceptions have been noted where these standards are not met periodically at some locations:
- Low levels of dissolved oxygen occur periodically in some parts of the system
- Total coliform concentrations exceed safe standards in the northwest fork near Jonathon Dickinson Park, in the North Fork near the Girl Scout Camp and at Dubois Park near the inlet.
- Rapid changes in salinity and increased turbidity are associated with high volume releases of freshwater from C-18 Canal during and after severe storm events.

Navigation and Recreation

- The Loxahatchee River and Estuary serve important functions as a regional recreational resource and tourist destination. These waters are used extensively and intensively for boating, canoeing, fishing, swimming, waterskiing and observing nature. Related commercial uses are centered around boat services, sightseeing cruises and fishing.

- Construction of the Intracoastal waterway resulted in the deepening and widening of channels, and increased water exchange between freshwater environments of Loxahatchee River and the brackish water systems in the southern end of the Indian River Lagoon and Lake Worth Creek.
- Construction and stabilization of the Jupiter Inlet permanently altered the balance of freshwater-saltwater exchange within this system, resulting in increased flow of saltwater upstream in the northwest fork and associated decline of freshwater vegetation along the riverbanks.
- Landward movement of saltwater has been further enhanced not only by drainage activities in the basin (see above) but also by removal of natural shoals and oyster bars to reduce the risk to navigation and provide access upstream by larger boats.

Exclusions:

District staff determined it was not appropriate to apply the exclusion in 373.0421(1)(b)1, regarding historic functions, to the establishment of minimum levels for Loxahatchee River System. This area has been greatly altered by development and associated needs for water supply and flood protection to the extent that full recovery of water levels and flows in the river headwaters, the river itself and the estuary may be technically and economically infeasible. However, the need to protect and enhance the remaining natural features in this system has been clearly identified. The Loxahatchee River and estuary and their associate watershed include a Federal and State-designated Wild and Scenic River, State Aquatic Preserves, state and local parks and have been designated as Outstanding Florida Waters. Furthermore, the considerations in Section 373.0421(1)(a) F.S. seem to adequately address the changes and alterations in water resource functions applicable to these areas. As a result, there is no apparent basis to invoke the exclusion in subsection (1)(b)1 or to document the economic and technical feasibility of recovery.

The remaining exclusions in subsections 373.0421(1)(b)2 through 3, F.S. pertain to water bodies less than 25 acres in size or constructed water bodies and as such, are not applicable to the Loxahatchee River and Estuary.